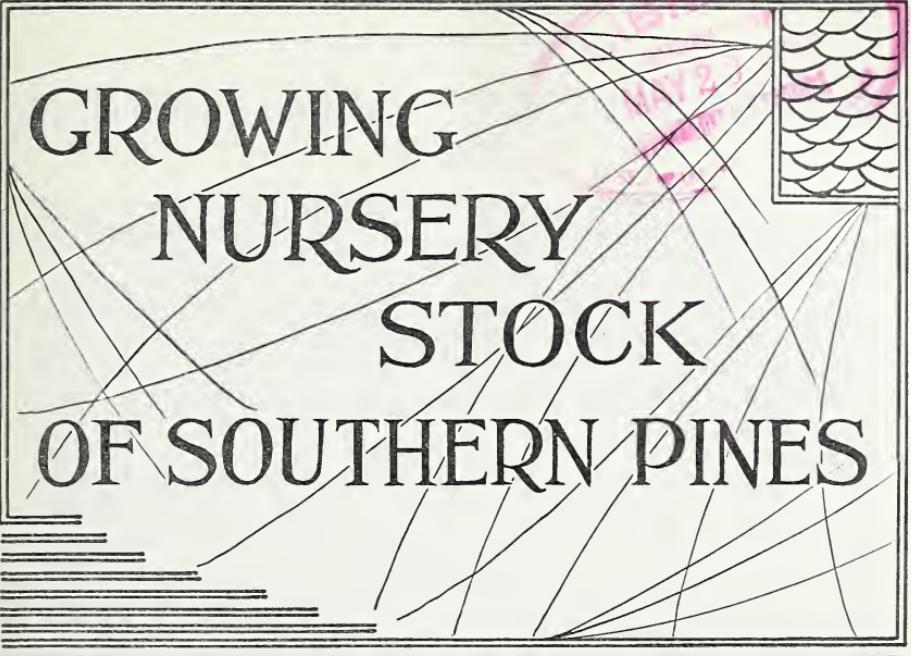
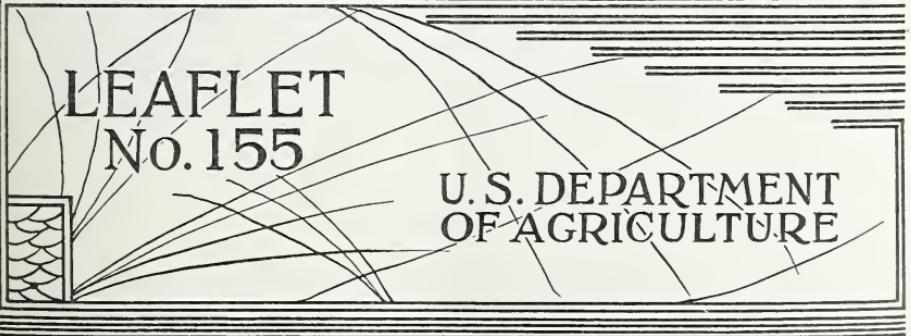


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**GROWING
NURSERY
STOCK
OF SOUTHERN PINES**




**LEAFLET
No. 155**

**U. S. DEPARTMENT
OF AGRICULTURE**

GROWING NURSERY STOCK OF SOUTHERN PINES¹

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Growing conditions are so good throughout most of the southern Atlantic and Gulf Coast States that seedlings of the southern pines—slash, loblolly, longleaf, and shortleaf pine—are usually large enough and well enough developed for planting in the field at the end of one growing season in the nursery, or in the northern part of this region, 2 years at most.

A few precautions and simple though constant care should make a nursery undertaking successful for the farmer, the small lumber operator, 4-H Clubs, Scout troops, or school classes. The problems of a large nursery, which require more detailed treatment, are covered in United States Department of Agriculture Technical Bulletin 492, Artificial Reforestation in the Southern Pine Region. Regardless of locality the production of good-quality seedlings requires (1) good seed, (2) good soil, (3) a well-prepared seedbed, (4) proper sowing of seed, (5) plenty of water, (6) careful weeding, (7) protection from diseases and insects, and (8) careful lifting and preparation for planting (fig. 1).

Seed

Southern pine seed, especially longleaf, gives best results if sowed the first spring after collection, though seed held one or more years in cold storage frequently gives good results, if not removed from storage until just before sowing. Seed may be obtained from seed dealers or from State departments of forestry, or collected and extracted locally by the user.

The plantations are most likely to thrive if the seedlings are grown from seed collected nearby (say, within 50 miles) or at least in a locality having the same general climate and soil. A record should always be made of the source of the seed used, if it is possible to learn it. One of the chief advantages of home collection and extraction of seed is that the source as well as the age of the seed is known beyond doubt.

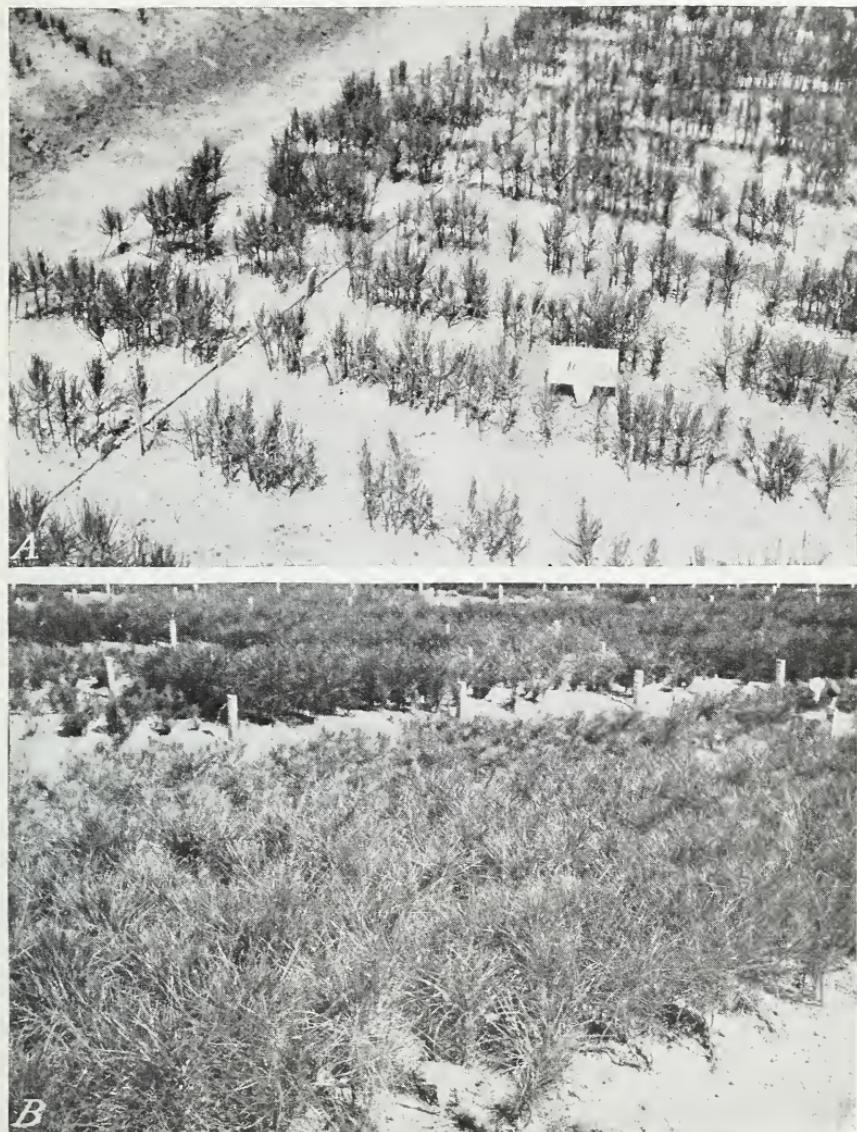
Seed should be gathered from trees of the best possible form. Care must be taken not to pick the cones too green; a good general rule is not to collect them until they are ripe enough to float in water immediately after picking. The seed may be extracted at air temperature or by artificial heat; if artificial heat is used, the temperature should not be allowed to go above 120° F. More detailed directions for collecting and extracting seed are given in United States Department of Agriculture Leaflet No. 156, Harvesting and Selling Southern Pine Seed.

¹ This leaflet is a revision of and supersedes Leaflet No. 35, Producing Pine Nursery Stock in the South.
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Seedbed Preparation

A seedbed 4 by 12 feet should produce about 1,500 to 3,000 plantable seedlings, depending on the species grown. This size bed, with a 6-inch unsowed shoulder on each side for protection against soil



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FIGURE 1.—Well-developed slash pine seedlings in May and in September, *A*, 40 days and *B* 180 days after the seed was sown. The white card in each case was 3 by 5 inches.

washing, has been found convenient in small nurseries, since it facilitates weeding. Most large nurseries use beds of this width, but longer.

Deep, well-drained, fairly level, loam or sandy loam soils, slightly to medium acid, are much better for nurseries than the heavier clays

and clay loams. Areas covered with weeds hard to eradicate, such as Bermuda grass or nutgrass (coco grass), should be avoided.

Before sowing, the soil must be worked very thoroughly to a depth of 8 inches or more to break up all lumps and remove all weeds. No heavy subsoil should be brought to the surface. After the beds have been measured and staked, they should be raised from 1 to 3 inches above the path level to provide for adequate drainage, by digging out the paths and throwing the soil onto the beds. The beds are then raked smooth.

Sowing the Seed

In most places early spring is the best season for sowing. In central Louisiana, excellent results are obtained by sowing as early in spring as the soil can be worked—February 10 to the middle of April. The seed may be broadcast over the bed or sown in drills 6 inches apart. Broadcast sowing is faster, unless a drill planter or seeding trough is used (fig. 2). Weeding and lifting are much easier in drilled beds.



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FIGURE 2.—Drilling longleaf pine seed with measuring cups and a seeding trough that opens at the bottom when the handles are pushed together.

For good seed, which should produce at least 30 plantable trees per 100 seeds, the approximate amounts that should be sown are given in table 1. In large nurseries more accurate guides are obtained by means of germination tests.

TABLE 1.—*Number and weight of seed to sow for different densities of seedlings, broadcast and drill methods*

Species and number of seeds per pound	Broadcast sowing			Drill sowing		
	Seed per square foot	Seed per 4-by 12-foot bed	Seedlings per square foot	Seed per linear foot	Seed per 4-by 12-foot bed	Seedlings per linear foot
	Number	Ounces	Number	Number	Ounces	Number
Longleaf (5,200)-----	100	16	25-35	45	16	12-18
Slash (15,500)-----	120	6	35-45	60	6	18-22
Loblolly (21,300)-----	130	5	40-50	65	5	20-25
Shortleaf (69,200)-----	130	2	40-50	65	2	20-25

After sowing, the seedbed should be rolled, or tamped firmly with a board, and then covered with single-thickness burlap, a light layer of pine needles, or a layer of sand *never* more than one-eighth inch deep. The beds should be watered well immediately after sowing.

The cover, if burlap or needles, should be carefully removed when about two-thirds of the germination has taken place, usually 2 to 3 weeks after sowing. As soon as the beds are uncovered, it will be necessary to protect the seedlings from birds. The worst offenders are meadowlarks, sparrows, blackbirds, and occasionally doves. Once germination is completed, however, the birds prove more beneficial than harmful, because of weed seeds and insects they devour.

If the stands of seedlings are very dense when germination has been completed and the seedlings are well established (usually late in May or early in June), it is advisable to thin the seedlings uniformly to about the spacings mentioned in table 1. This is best done by cutting the surplus seedlings with scissors rather than by pulling. Overdense seedlings are usually weak and underdeveloped.

Watering

During the germination period the seeds and soil must not be allowed to dry out. Therefore some provision should always be made for artificial watering. Artificial watering is also desirable after germination if the ground becomes hard and dry or the seedlings show signs of drought injury. For the best development of seedlings, nurserymen have found the equivalent of about 1 inch of rain per week to be needed. The larger nurseries must have provisions for artificial watering, either by overhead sprinkler systems or by irrigation.

If enough water is not available, lath shades may be used to reduce the quantity of water needed by the seedlings. These shades consist of strips of wood lath stapled an inch or two apart on two wires and placed on a wooden frame about 18 inches above the bed. The shades should be used only during the hottest, driest periods and should be removed in rainy or cloudy weather. After about August 1 they should not be used. Southern pines, if sufficiently watered, usually need no shade; shortleaf pine is sometimes an exception. Artificial watering should usually be discontinued about September 1, to harden off the seedlings.

Injuries due to heat are not common. Drought injury, which sometimes occurs, can usually be recognized because it comes during periods of dry, hot weather. Growth is poor, and seedlings become yellowish and finally turn brown and die. The remedy is increased water, or shading if water is not available.

Weeding

It is most important to keep out the weeds in forest-tree nurseries. By careful and frequent hand weeding when the weeds are small, much tedious labor can be avoided later. As mentioned before, weeding in drilled beds is easier than in broadcast-sown beds. Narrow hoes are useful for weeding between drills.

Protection from Diseases and Insects

Losses in pine nurseries while the seedlings are still very small are often due to diseases of the group known as "damping-off", which may

attack seedlings at any stage from germination until vigorous growth has formed secondary needles. Roots of affected seedlings turn brownish and watery. During the early period, seedlings may collapse at the ground line while the tops are still rigid, or the entire seedling may wilt suddenly. Wet weather favors development of the disease, and longleaf pine is the species most commonly attacked.

Losses due to damping-off are ordinarily lowest in nurseries located on acid soils. Aluminum sulphate at the rate of 0.25 to 1 ounce in 1 to 2 pints of water per square foot may be applied to acidify nursery soils. Beds treated with aluminum sulphate should never be allowed to suffer for water before the seedlings are well out of the ground. Except upon expert advice, based on visits to the nursery or tests of the soil, these treatments should not be tried over large areas until they have proved helpful in small-scale tests. Both sulphuric acid and formaldehyde have also reduced losses due to damping-off, but their use requires special precautions.

Another disease, which often appears in nurseries in the summer, is the brown spot needle blight. This disease is characterized by brown spots which first appear near the tips of needles. Unless the disease is checked, most of the foliage of affected seedlings may be killed by the following spring. Longleaf pine is most susceptible. Spraying three to four times during a growing season with bordeaux mixture containing an adhesive, such as fish-oil soap or casein spreader, will give effective control.

Detailed information concerning the control of these diseases may be obtained from the Southern Forest Experiment Station, New Orleans, La., or the Division of Forest Pathology, Bureau of Plant Industry, Washington, D. C.

Among the more important insect pests in pine nurseries are white grubs, cutworms, and mole crickets, all of which burrow underground and cut off the roots. Certain species of cutworms also cut off young seedlings just above the soil surface. Tip moth larvae injure the new growth, sawfly larvae defoliate, and scale insects and aphids injure the needles, thus weakening the seedlings. In some cases the Florida harvester ant has been found to destroy seeds and to cut seedlings in the cotyledon stage. It is of some help when lifting seedlings or making up the beds, to hand-pick white grubs and other insects that damage the roots of seedlings. If there is a serious infestation, carbon disulphide emulsion should be used. The other types of insects can be controlled by the use of poison baits or sprays. Specific information on the insects that attack pine seedlings can be obtained by writing to the Southern Forest Experiment Station, New Orleans, La., or the Division of Forest Insect Investigations, Bureau of Entomology and Plant Quarantine, Washington, D. C.

Nursery operators should constantly bear in mind that no special treatment can take the place of watchful, daily care by someone of ordinary judgment and common sense. The important thing is to catch trouble at the start and correct conditions before serious loss occurs.

Lifting

By the time (usually late November or early December at the earliest) that most of the seedlings have well-formed buds, and before

any very large percentage of these buds start new growth, seedlings should be lifted and planted.

In small nurseries the seedlings will usually be dug by hand. In most soils the roots will be longer than can readily be planted, making root pruning needful. This is sometimes done by digging with a sharpened shovel, but more often the roots of the plantable trees are cut to the right length with a hatchet or knife, after lifting. For most planting sites they should be cut off cleanly 8 inches below the ground line; on light, droughty soils it may pay to plant roots 10 to 14 inches long.

In lifting, great care must be used to loosen the earth well and to avoid peeling, splitting, or breaking the roots. The roots must be



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FIGURE 3.—(A) Longleaf and (B) loblolly pine seedlings after 1 year in the nursery, showing grades 1, 2, and 3 of each. Grades 1 and 2 are plantable; grade 3 should be culled.

kept moist at all times, by means of loose earth, moist moss or sawdust, or wet sacks.

It usually pays to grade nursery stock fairly severely (fig. 3), discarding all seedlings seriously injured by insects or disease, noticeably broken in lifting, or with very short or scanty roots, as well as all those not having at least part of their needles in bunches of two or three and possessing stems at least one-eighth inch thick at the ground (three-sixteenth inch for longleaf). Further details concerning seedling grades are given in Leaflet No. 159, Planting Southern Pines.

The less time lost between lifting and planting, the better. The seedlings can be taken to the planting area packed in wet moss, shingle tow, or sawdust. If they must be kept any length of time either at the nursery or at the planting area, they should be heeled in (fig. 4) in a layer 3 to 5 inches thick, against the slightly sloping side

of a trench dug about 9 inches deeper than the roots, with earth packed firmly over the roots and the lower part of the stem.

Costs

For the most part, producing southern pine seedlings is not at all expensive. It is difficult to set a figure because of the great variation in cost of different steps in the process. Seed may be obtained free or may cost anywhere from a few cents to a dollar a pound or more; labor may cost nothing or up to \$1 or \$2 per thousand seedlings; materials and tools are ordinarily available. Commercial nurseries



FIGURE 4.—Pruning the roots and heeling-in bundled longleaf seedlings in a sloping trench. The roots are covered to the ground line, and the soil firmly tamped against them to prevent drying out.

have produced seedlings at costs of \$2 to \$8 per thousand. A small operator, free from large overhead and contributing his own labor and tools, may reduce this cost to the small cash outlay for seed.

Further Information

Further information on nursery practice for growing southern pines can be obtained from the United States Forest Service, Washington, D. C.; from the State foresters at Montgomery, Ala.; Little Rock, Ark.; Tallahassee, Fla.; Atlanta, Ga.; New Orleans, La.; Baltimore, Md.; Jackson, Miss.; Raleigh, N. C.; Oklahoma City, Okla.; Columbia, S. C.; Nashville, Tenn.; College Station, Tex.; and from the extension forester at the State agricultural college of each State.

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